RSVP Review Status Sheet

WBS No. 1.3.1 Title: Extinction **Date 01/18/05**

Preparer/Manager: William Molzon **Current Cost Est. (FY05 $M) = 2.3**
Assigned Contingency % = 43%

Cost Elements (FY05$M): Matls. = 1.03; Effort = 0.36; Ohd. = 0.20; Conting. = 0.69; Total = 2.28

WBS Dictionary Definition: This item comprises 4 major sub-items; a way of measuring the time structure in the circulating AGS beam, a magnet system in the primary proton beam that provides a time modulated magnetic kick phased with the proton micropulses, a system of magnets, collimators and detectors that can be used to measure the time structure of particles in the extracted beam (upstream of the secondary extinction device) with a dynamic range of 10^9 within a few minutes, and a system of magnets, collimators and detectors that can be used to measure the time distribution of particles hitting the muon production target with a dynamic range of 10^9 in a few minutes.

Technical Level of Confidence:	*Prototype* Demonstrated	__	*Elements* Built & Tested	__
(choose one)	Similar *system* exists	_x_	Similar *technology* works	_x_
	Novel system concept	__	No candidate concept yet	__
	Other: Different parts can be described by each of the above			

Basis of the Cost Estimate:	Commercial product	20%	Engineered design	5%
(by percentage of total cost;	Engineered conceptual	5%	Scientist conceptual	35%
sum of fractions a-f = 100%)	Guess	35%	Other (specify)	f%

Status of Hardware/Software Development: Some items (e.g. small dipole magnets with power supplies) exist and they need refurbishing; this cost is identical to that for other magnets as estimated by AGS personnel. Most hardware designs (e.g. the RF modulated magnets and their power supplies and network) exist only in a conceptual sense; similar stripline magnets are used at the AGS, but no hardware development specific to our magnets has been done. It is likely that the RF power amplifiers will be commercial products, either off-the-shelf or modifications made by commercial vendors. These devices are used for a number of applications such as AM radio and plasma power devices. A very small prototype of the LRC network has been made and a commercial vendor for the capacitors has been found. The detectors for the extinction measurements external to the AGS are similar to detectors built for many similar applications and no prototype or hardware development specific to our devices has been done. The software necessary to do the design work exists (TOSCA and ELECTRA models, GEANT models) for the devices we will build.

Issues (funding, collaborator shortage, engineering help, etc.): We need physicist power to do the studies and we have a graduate student experienced in TOSCA and ELECTRA doing this now; he is also doing the GEANT studies. We need a postdoc to work on this for which we don't currently have funds, and also mechanical and electrical engineering help. We are searching for a mechanical engineer (for which we have funds for one year salary) and will need a fraction of an electrical engineer's effort on this, for which we do not have money. Testing the performance of both the extinction in the AGS and the performance of this device in a beam are both critical, and the currently foreseen schedule is very late.

RSVP Review Status Sheet

WBS No. 1.3.2 Title: "Production Target and Shield" **Date 01/17/05**

Preparer/Manager: "Hebert" **Current Cost Est. (FY05 $M) = 2.76**
Assigned Contingency % = 40.9%

Cost Elements (FY05$M): Matls. = 1.78; Effort = 0.12; Ohd. = 0.06; Conting. = 0.80; Total = 2.76

WBS Dictionary Definition: "This task includes a conceptual design for the experiment's water-cooled pion production target, prototype testing of that design, and the design and fabrication of the heat and radiation shield within the Production Solenoid. Note that although the costs for MECO participation in beam testing of the production target are included here, the larger costs of running the beam and preparing an area for the test are contained in WBS 1.4.4. The water-cooled heat shield serves to limit the nuclear heating and radiation damage to the coils of the Production Solenoid as well as supporting the target assembly."

Technical Level of Confidence:	*Prototype* Demonstrated	__	*Elements* Built & Tested	__
(choose one)	Similar *system* exists	__	Similar *technology* works	X
	Novel system concept	__	No candidate concept yet	__
	Other (Comment)			

Basis of the Cost Estimate:	Commercial product	0%	Engineered design	20%
(by percentage of total cost;	Engineered conceptual	0%	Scientist conceptual	60%
sum of fractions a-f = 100%)	Guess	20%	Other (specify)	0%

Status of Hardware/Software Development: "We have an incomplete design study of the heat shield. That study did not reach the point of producing a cost estimate prior to the lead engineer leaving the lab. We have detailed thermodynamic and hydrodynamic models of the production target, backed up with prototypes tested using induction heating."

Issues (funding, collaborator shortage, engineering help, etc.): "We have identified a potential new collaborator that has an interest in taking on the heat shield portion of this system. The production target design effort at UCI would benefit from a post-doc dedicating a significant fraction of his or her time to studying details and conducting prototype induction heating tests."

RSVP Review Status Sheet

WBS No. 1.3.3 Title: Solenoids **Date 01/13/05**

Preparer/Manager: Brad Smith **Current Cost Est. (FY05 $M) = 55.2**
Assigned Contingency % = 28.6%

Cost Elements (FY05$M): Matls. = 18.6; Effort = 12.4; Ohd. = 12.4; Conting. =12.3; Total = 55.2

WBS Dictionary Definition:
This comprises the complete set of superconducting magnets including the magnets themselves (coils, mandrels, thermal shields, vacuum vessels, internal sensors, interface connections, etc.), the power supplies, the control system, the liquid helium refrigerator/liquefier, and any control box for cooling distribution.

Technical Level of Confidence:	*Prototype* Demonstrated	__	*Elements* Built & Tested	__
	Similar *system* exists	__	Similar *technology* works	__
	Novel system concept	__	No candidate concept yet	__
	Other (Comment)			

The MECO magnet system design is currently based on a mature conceptual design which has been presented in detail in the Conceptual Design Report (CDR) and subsequent updating memoranda, and which has been successfully reviewed now several times by both national and international magnet review teams. The design itself represents an assembly and integration of a large number of smaller components, most of which can be considered as technologically similar to items which have been previously successfully fabricated. A large challenge of this project is with the overall size of the system. A successful magnet system requires attention to detail in the final design process, an approved, quality-assured, and in-control manufacturing process, and an installation approach which has been carefully planned and agreed to by the MECO project, the fabrication Vendor(s), and BNL. Preliminary tolerance studies conducted at MIT/UCI have shown that specification of warm magnet dimensions with reasonable manufacturing tolerances should be sufficient to provide magnets that will meet the field specification when the magnets are cooled to 4.5 K and energized.

Basis of the Cost Estimate:	Commercial product	5%	Engineered design	0%
(by percentage of total cost;	Engineered conceptual	95%	Scientist conceptual	0%
sum of fractions a-f = 100%)	Guess	0%	Other (specify)	0%

The magnet cost estimate is based on a MIT bottoms-up estimate of the individual cost items. Labor is generally estimated based on a detailed hourly breakdown of each task using appropriate labor categories with industry-standard labor rates. A selected sub-set of the cost elements (conductor, coil mandrels, magnet iron, power supplies, quench protection equipment, refrigerator/liquefier) were obtained via budgetary estimates from industry. Also, General Atomic (San Diego, CA), in an industrial subcontract to UCI, provided generally corroborating costs for each of the PS, TS and DS magnet cryostats and their contents, which comprise 56% of the estimated WBS 1.3.3 cost total. Magnet costs have been reviewed once at the end of the CDR in Feb02 and again at the RSVP magnet review in Oct04.

This cost estimate includes the full estimated cost for magnet final design as presented in the Oct04 magnet review. This amount is within a few percent of the amount included in a detailed final design plan for the magnet presented in a meeting at BNL on December 13, 2004. A supplemental funding request has been submitted by RSVP to provide early funding for RSVP project management and for high priority magnet design activities identified in the Oct04 review. The amount of the supplemental funding request that would accrue to the magnets, if approved in full, would be $690 k. Any amount awarded to the magnets from the supplemental request would decrease the $55.2 M identified here on a dollar by dollar basis.

Status of Hardware/Software Development:
Much of the magnet hardware relies on superconducting magnet technology that has been available in the community at large for some time. A limited number of low-cost R&D tasks have been proposed as part of the present plan for magnet final design that will lead more confidently to a fabrication specification for the magnets. The magnet R&D tasks are generally intended to retire risk on certain aspects of the design through laboratory testing of manufactured samples and prototypes. Specifically, these R&D items include the following:

Conductor testing

Three types of conductor tests are planned. In all cases, any degradation noted in the test sample measurements will be accommodated in the final design.

- SSC inner cable test
  SSC inner and outer cables are key-stoned and have been in storage on spools since the 1990's. MECO uses both inner and outer cable types which will generally be soldered into copper channels to provide adequate cross-section for parallel current flow during magnet quench. The production solenoid (PS) conductor operates in the highest field and therefore uses SSC inner cable. It operates with the lowest temperature margin of 1.5 K. Therefore, a short length of SSC-inner cable will be sent to BNL for critical current testing ($J_c(B)$) and data will be compared with historical SSC inner cable data.

- De-keystoned SSC outer cable test
  The TS coil modules close to the anti-proton-stopping window have large radial builds to maintain magnetic field in the warm gap. To avoid excessive radial builds, these modules use bare, de-keystoned, SSC outer cable. The cable has sufficient copper cross-section for quench protection without the need for the copper channel. De-keystoning this cable will enable the maintenance of a high winding pack fraction and smooth coil layer geometry. Therefore, a short length of SSC-outer cable will be sent to New England Wire for de-keystoning, and then to BNL for critical current testing. Test data will be compared with historical SSC outer cable test data.

- SSC inner cable-in-channel test
  A trial length of PS cable-in-channel conductor will be fabricated at Outokumpu. A short length of this sample will be sent to BNL for critical current testing. Test data will be compared with bare cable test results.

Conductor stack tests
Rectangular, prism-shaped, stacks of insulated conductors will be tested to determine the compressive and tensile moduli of the composite winding. Data will be taken at room temperature and at 77 K. This measurement data will be used to re-evaluate magnet quench stresses which are driven by thermal strain.

Copper winding
A TS-sized copper winding is planned to validate electrical insulation materials and impregnation processes. The coil design will enable cryogenic winding temperature measurements intended to validate the conduction-cooled design in a later step in the plan. Conduction cooling the PS was a recommendation of the MOG in the Oct04 magnet review. Copper coil fabrication is funded by the supplemental request, but follow-on testing requires additional funding. The test plan calls for cooling the copper coil to near liquid helium temperature and then to energize it at low current to create a heat flux at the cooled surface

that is equal to the heat flux from the nuclear heat load in the PS. Coil temperature distribution will be measured. The coil will then be pulsed to high current to simulate high Lorentz loading. The coil with then be re-cooled to near liquid helium temperature and the temperature distribution measurements at low current repeated. Finally, the copper test coil will be sectioned and examined.

Joint trials
Clamping, heating and soldering techniques will be established to form the basis of conductor joint fabrication processes.

Issues (funding, collaborator shortage, engineering help, etc.):

Funding
Some R&D tasks (3 out of 4 conductor stack tests, copper winding, and joint trials) and many final design tasks require funding from the RSVP Supplemental request and from the FY05 RSVP MREFC funding authorization. MIT has prepared a magnet final design plan which will lead to one or more RFP's for the magnet system. The schedule for this plan is highly dependent upon the timely arrival of funds from both the Supplemental request and from the FY05 RSVP MREFC funding authorization.

Engineering personnel
The MIT final design plan was presented in an exploratory meeting with RSVP management, the MOG chairman, and leaders from BNL-SMD on December 13, 2004. In this meeting, MIT proposed a task sharing arrangement whereby BNL personnel might contribute to the final design of the magnet peripheral equipment. No action was taken at this meeting, but an early clarification of any possible BNL role would facilitate planning.

Design for safety
A key deliverable during the magnet final design period is the documentation package that will support a magnet RFP. This package will include a statement of work for magnet fabrication and a fabrication specification that captures key requirements for not only magnet performance but also safety. A clear methodology for melding BNL safety committee requirements into the final design activity and incorporating those requirements in the magnet documentation package is needed. MIT presented some preliminary recommendations regarding safety integration into the magnet design at the December 13 meeting, but no action has been taken.

RSVP Review Status Sheet
Due in RSVP Project Office on January 14, 2004

WBS No. 1.3.4 Title: Muon Beamline **Date 01/14/05**

Preparer/Manager: William M. Morse **Current Cost Est. (FY05 $M) = 3.59**
Assigned Contingency % = 26%

Cost Elements (FY05$M): Matls. = 1.24; Effort = 0.99; Ohd. = 0.59; Conting. = 0.73; Total = 3.59

WBS Dictionary Definition:

1.3.4 Muon Beamline

The muon beamline consists of the elements within the Transport Solenoid that define the beam and those within the Detector Solenoid that are not used to detect conversion electrons. In the Transport Solenoid these include three collimators that define the accepted muon momentum spectrum, the anti-proton stopping window, and the vacuum system. The muon beam stop is a reentrant dump at the exit of the detector solenoid in which muons that neither stopped in the target nor decayed come to rest. The neutron absorbers consist of lithium or boron doped polyethylene in a cylindrical shell around the region of the stopping target at large radius. The purpose is to absorb neutrons emitted following muon capture. A system of rails both on the floor of the experimental area and on the lower portion of the Cosmic Ray Shield allow the End Cap Support to translate. It will also provide support for intermediate carts required by the tracker and calorimeter. A Germanium crystal x ray detector measures the absolute rate for muonic atom formation, and functions as a continuous real-time muon beam monitor.

1.3.4.1 Vacuum System

Vacuum System is the warm bore region of the Solenoid Magnets as described in "Muon Beamline Vacuum System Reference Design". The vacuum level is 10^-4 Torr. The vacuum is divided into the DS Vacuum and the PS Vacuum. The PS/TSu and TSd/DS vacuum seals are the responsibility of the Solenoid vendor. The PS Vacuum End Plate, Anti-Proton Stopping Window, Vacuum Pump Spool Piece and Instrumentation Feed-thru Bulkhead vacuum seals are the responsibility of their respective WBS's.

1.3.4.1.1 Detector Solenoid Vacuum System

The DS Vacuum is bounded by the warm bores of the TSd and DS, the Anti-Proton Stopping Window, the Vacuum Pump Spool Piece (WBS 1.3.4.8.6) and the Instrumentation Feed-thru Bulkhead.

1.3.4.1.2 Production Solenoid Vacuum System

The PS Vacuum is bounded by the warm bores of the PS and TSu, the Anti-Proton Stopping Window (WBS 1.3.5.7), the PS Vacuum End Plate (WBS 1.4.4.2.5.3) and the Proton Beamline Vacuum Window (WBS 1.4.4.2.5.1).

1.3.4.1.3 pBar Window Protection System

The pBar Window Protection System is necessary to prevent the window from being overstressed by a large vacuum differential between the PS & DS (the limit is ~8psi). This system will control the rate of pump down/ bleed up as well as operate an emergency bypass valve.

1.3.4.2 TS Collimators and Shielding

The collimators select the appropriate charge and momentum of particles transported to the DS. The shielding shields the TS coils and DS detectors from harmful radiation.

1.3.4.2.1 Collimators Col 1-5

Three brass or copper collimators situated in the TS. The central collimator is split into upstream and downstream halves, one each in TSu and TSd, adjacent to the Anti-proton Stopping Window package. This also includes the twelve copper foils inside the last collimator (see MECO Memo #100).

1.3.4.2.2 Shielding S1-6

Copper shielding inside the TSu warm bore to protect the coils from the beam.

1.3.4.3 Muon Stopping Target

The muon stopping target is a system of 17 thin Al or Ti foils supported with a low mass suspension in the detector solenoid.

1.3.4.4 Detector Shields

The detector shields are thin, low z cylinders and cones in the region between the stopping target and tracking detector that serve the purpose of absorbing low energy protons emitted from the stopping target following muon capture.

1.3.4.5 Muon Beam Stop

The muon beam stop is a reentrant dump at the exit of the detector solenoid in which muons that neither stopped in the target nor decayed come to rest. It contains a low Z absorber at large radii (near the wall of an extension to the detector solenoid and an albedo shield of high Z material to absorb albedo. Provisions are made for it to be quickly removed to provide access to the interior of the detector solenoid.

1.3.4.6 Anti-Proton Stopping Window

The Anti-Proton Stopping Window is defined in "Anti-Proton Stopping Window Design Report". This window stops anti-protons produced in the Production Target from reaching the DS. It also serves to separate the vacuum volume of the DS from the PS to prevent

1.3.4.7 Neutron Absorbers

The neutron absorbers consist of boron doped polyethylene in a cylindrical shell around the region of the production target at large radius. The purpose is to absorb neutrons emitted following muon capture. Boron is used because it has a large cross section for neutron capture without subsequent photon emission.

1.3.4.7.1 Internal Absorbers

These are the absorbers that lie within the DS vacuum volume.

1.3.4.7.2 External Absorbers

These absorbers are external to the DS.

1.3.4.8 Detector Support Structure

This is the system of support rails and carriages required to mount all of the detectors located within the Detector Solenoid. This includes the Stopping Target, the Detector Shields, the Tracker, the Calorimeter, and the Muon Beam Stop.

1.3.4.8.1 Internal Rail System

The system of rails installed within the Detector Solenoid upon which the detector support carts roll.

1.3.4.8.2 End Cap Support and Carriage

The structure that supports the weight of the muon beam stop/vacuum end cap and allows it to translate to afford access to the interior of the Detector Solenoid.

1.3.4.8.3 External Rail System

A system of rails both on the floor of the experimental area and on the lower portion of the Cosmic Ray Shield that allow the End Cap Support to translate. It will also provide support for intermediate carts required by the tracker and calorimeter as they are removed from the Detector Solenoid.

1.3.4.8.4 Intermediate Carriages

These provide support for the Tracker and Calorimeter when they are removed from the Detector Solenoid.

1.3.4.8.5 Muon Stopping Target Support

This is the support for the Muon Stopping Target and the Detector Shields.

1.3.4.8.6 Vacuum Pump Spool Piece (VPSP)

This is the vacuum closure at the downstream end of the DS and it provides a method of passing signal, power and service lines through the vacuum wall.

1.3.4.8.7 Instrumentation Feed-thru Bulkhead

This is the vacuum closure at the downstream end of the DS and it provides a method of passing signal, power and service lines through the vacuum wall.

1.3.4.8.8 Vacuum Feed-thru's

Purchase & installation of vacuum feed-thru's for signals, high voltage, pre-amp power, gating & calibration and gas & cooling lines.

1.3.4.9 Stopping Target Monitor

A high resolution germanium detector will view the muon stopping foils from 15m downstream to collect spectra of characteristic muonic Al-atom x-rays. Observable muonic-Al transitions at 1.2 keV resolution would primarily be the 2p-1s (356 keV), the 3p...

1.3.4.9.1 Germanium Detector

A commercial 40% relative efficiency, N-type intrinsic Ge detector will be purchased. This type is less sensitive to neutron damage caused by muon capture neutrons. Annealing of the crystal could still be needed after 3 months of running.

1.3.4.9.2 Electronics

Front end electronics will consist of a low noise preamp and a high rate, PC-controlled spectroscopy amplifier. The preamp will be a resistive, fast-reset preamplifier capable of handling 800,000 MeV events per sec. An analysis software and hardware-co...

1.3.4.9.3 DS Window and Transport Pipe

X rays pass through a strong, but highly transparent Ti port at the tail end of the DS and enter a free-standing 2 m long, 5cm dia helium-filled pipe. This pipe passes through the SS wall, the CR detector, and the back concrete shield wall where the x ray detector is situated.

1.3.4.9.4 Magnetic Deflector

The initial flash of beam electrons has energies ranging up to 70 MeV and a flux 20 times greater than that of negative muons. Should a high number of these traverse the transport pipe a magnetic deflector can be added.

Technical Level of Confidence: (choose one)	*Prototype* Demonstrated	__	*Elements* Built & Tested	__
	Similar *system* exists	_x_	Similar *technology* works	__
	Novel system concept	__	No candidate concept yet	__
	Other (Comment)			

Basis of the Cost Estimate:	Commercial product	15%	Engineered design	10%
(by percentage of total cost;	Engineered conceptual	40%	Scientist conceptual	25%
sum of fractions a-f = 100%)	Guess	10%	Other (specify)	

Status of Hardware/Software Development: Presently we're doing the physics/ engineering specifications and engineering conceptual designs.

Issues (funding, collaborator shortage, engineering help, etc.). The main issue is that the teamleader (WMM) is doing the physics calculations; see MECO tech notes: 117 and 139 "MECO Detector Solenoid Vacuum Requirements", 98 "DIO Backgrounds with a Ti Target", 88 "Design Considerations for the Anti-proton Stopping Window", 82 "Probability of Proton Ejection from Muon Capture on Aluminum", plus Muon Beamline Semester Reports: 118, 109, 102, 89, 79. Presently I am doing simulations to specify the required tolerances for placement of the collimators. I also would like to think about cosmic ray veto, extinction, and the level 0 trigger physics issues. Additional MECO physics effort in the BNL Physics Department, besides Yannis Semertzidis (extinction) and Peter Yamin (neutron calculations) would have an immediate positive impact, but I'm told "there ain't no money". This is an issue.

RSVP Review Status Sheet

Due in RSVP Project Office on January 14, 2004

[Please fill in all items in red type]

WBS No. 1.3.5 Title: Straw Tracker **Date 01/15/05**

Preparer/Manager: Ed V. Hungerford **Current Cost Est. (FY05 $M) = 4.74**
Assigned Contingency % = 19%

Cost Elements (FY05$M): Matls. = 2.7; Effort = 2.0; Ohd. = 0; Conting. = 0; Total = 4.7

WBS Dictionary Definition: The WBS describes the design, purchase and construction of the electron tracking detector.

Technical Level of Confidence: (choose one)	*Prototype* Demonstrated	__	*Elements* Built & Tested	__
	Similar *system* exists	__	Similar *technology* works	X__
	Novel system concept	__	No candidate concept yet	__
	Other (Comment)			

Basis of the Cost Estimate:	Commercial product	15%	Engineered design	25%
(by percentage of total cost;	Engineered conceptual	5%	Scientist conceptual	30%
sum of fractions a-f = 100%)	Guess	24%	Other (specify)	0%

Status of Hardware/Software Development:
There are two possible detector designs under consideration. The present summary costs the most expensive design, although the price difference between the two designs is only 3.5%. The designs use existing technologies, and the choice between them will be mainly physics driven.

Mechanical design

A prototype vane of the L-tracker has been constructed, and problems identified. Several types of resistive straw have been developed and R&D will select the one which is more mechanically rigid with the best resistivity. Costs of these are similar. Various prototypes with strip readout have been tested with beams and sources. Mechanical stability of the L-tracker needs design. A prototype T-tracker plane is under construction. Appropriate straws of both 15 and 25 um for this tracker have been produced.

Electronics

A preliminary electronic readout system has been constructed and tested using prototype detectors with both anode and cathode readout. This system contains digitization for both time and waveform, and is operated under local FPGA control. Design specifications for the digitizing ASIC are essentially completed and engineering work scheduled to begin at LBL in March/April.

Issues (funding, collaborator shortage, engineering help, etc.): Engineering design, mainly mechanical, is critically needed. Funding at an appropriate level to complete the detector R&D so that the detector design can be fixed is necessary. Additional personnel to develop, in particular the L-tracker prototype, is desirable

RSVP Review Status Sheet
Due in RSVP Project Office on January 14, 2004

WBS No. 1.3.6 Title: "Electron Calorimeter" **Date 01/14/05**

Preparer/Manager: "Peter Nemethy"

Current Cost Est. (FY05 $M) = 07.92
Assigned Contingency % = 24.4%

Cost Elements (FY05$M): Matls. = 04.2; Effort = 01.4; Ohd. = 00.8; Conting. = 1.6; Total = 7.9f

WBS Dictionary Definition: "Electron Calorimeter. The calorimeter is the primary hardware trigger for the experiment and constrains the measured electron energy and reconstructed impact point (shower centroid) in each event. The calorimeter consists of 4 vanes of 288 Lead-tungstate crystals for a total of 1152 crystals and 2304 channels of detectors and readout electronics"

Technical Level of Confidence:	*Prototype* Demonstrated	__	*Elements* Built & Tested	X__
(choose one)	Similar *system* exists	__	Similar *technology* works	__
	Novel system concept	__	No candidate concept yet	__
	Other (Comment)			

Basis of the Cost Estimate:	Commercial product	5%	Engineered design	%
(by percentage of total cost;	Engineered conceptual	%	Scientist conceptual	85%
sum of fractions a-f = 100%)	Guess	10%	Other (specify)	%

Status of Hardware/Software Development: " Laboratory bench tests of complete calorimeter channels and their readout electronics are under way, at the fewer than 10 crystal level"

Issues (funding, collaborator shortage, engineering help, etc.): "Senior Electrical Engineer (chief electrical engineer for MECO) has not been hired yet at NYU, but will be needed for both the design and building phases. Mechanical Engineering and Designer effort from outside NYU will be needed for the mechanical and cooling design and construction. A 25 crystal Prototype beam test in a laser backscattering experiment will be needed."

RSVP Review Status Sheet

WBS No. 1.3.7 Title: Cosmic Ray Shield **Date 01/17/04**

Preparer/Manager: John Kane **Current Cost Est. (FY05 $M) = 1.67**
Assigned Contingency % = 13%

Cost Elements (FY05$M): Matls. = 1.17; Effort = 0.20; Ohd. = 0.10; Conting. = 0.19; Total = 1.67

WBS Dictionary Definition: This WBS element consists of the active part of the cosmic ray shield, including multiple layers of scintillation counters, with photodetectors, preamps, calibration system. The trigger electronics and DAQ are not part of this subsystem. The passive shield (concrete) is not included in this WBS item. Manpower for installation in the experiment is not included. Simulation of the performance is not included in this WBS. Much of the cost is in academic personnel, the cost of which is not included.

Technical Level of Confidence:	*Prototype* Demonstrated	__	*Elements* Built & Tested	_x_
(choose one)	Similar *system* exists	__	Similar *technology* works	__
	Novel system concept	__	No candidate concept yet	__
	Other (Comment)			

Basis of the Cost Estimate:	Commercial product	60%	Engineered design	0%
(by percentage of total cost;	Engineered conceptual	%	Scientist conceptual	40%
sum of fractions a-f = 100%)	Guess	%	Other (specify)	0%

Status of Hardware/Software Development: Small prototypes have been built and tested. The plastic scintillator is very close in design to that used for the MINOS detector. The readout WLS and optical fibers and the photodetectors are commercial products. The performance can be reliably estimated from the extensive MINOS experience.

Issues (funding, collaborator shortage, engineering help, etc.): Some engineering help is needed in the short term, primarily on support structures. It is anticipated that the William & Mary group will get some additional help from additional collaborators. It is important to get a renewed simulation effort underway, and a postdoc or advancd graduate student is needed for this effort.

RSVP Review Status Sheet

WBS No. 1.3.7 Title: Simulation & Offline Analysis **Date 01/17/04**

Preparer/Manager: Yury Kolomensky **Current Cost Est. (FY05 $M) = 0.97**
Assigned Contingency % = 46%

Cost Elements (FY05$M): Matls. = 0.64; Effort = 0.0; Ohd. = 0.0; Conting. = 0.29; Total = 0.93

WBS Dictionary Definition: This WBS element consists of the simulation and offline analysis for all WBS elements. Major parts are for the tracker, calorimeter, simulations of various parts of the beamline. It includes development of an integrated simulation and analysis framework. Essentially all of the effort is by academic personnel and hence not costed. The effort cost, if included, would add approximately $3.5M.

Technical Level of Confidence: (choose one)	*Prototype* Demonstrated	__	*Elements* Built & Tested	__
	Similar *system* exists	_x_	Similar *technology* works	__
	Novel system concept	__	No candidate concept yet	__
	Other (Comment)			

Basis of the Cost Estimate:	Commercial product	100%	Engineered design	0%
(by percentage of total cost;	Engineered conceptual	%	Scientist conceptual	0%
sum of fractions a-f = 100%)	Guess	%	Other (specify)	0%

Status of Hardware/Software Development: There has been no work on this.

Issues (funding, collaborator shortage, engineering help, etc.): Approximately 2/3 of the personnel needed to do this work are not currently in the collaboration. It will require hiring experienced physics software developers, and the primary difficulty with this is likely to be the long time scale before physics results are expected. The subsystem manager must get a number of people with possibly divergent views on software development to work together, and this has often been difficult.

RSVP Review Status Sheet

WBS No. 1.3.8 Title: "Trigger and DAQ" **Date 01/17/04**

Preparer/Manager: "K. Kumar"

Current Cost Est. (FY05 \$M) = 2.47
Assigned Contingency % = 25.4%

Cost Elements (FY05\$M): Matls. = 1.4; Effort = 0.4; Ohd. = 0.3; Conting. = 0.5; Total = 2.5

WBS Dictionary Definition: "This consists of the electronics and computer hardware and software needed to trigger the readout electronics using fast energy sums in the calorimeter, assemble event records, and store selected events for offline analysis. This includes digitizer boards for energy sums, pipelines for buffering event information during trigger processing, event builders for record assembly, a processor farm for post-trigger processing, and a permanent data storage system. Also included is a separate system of electronics and software for slow control and monitoring of all subsystems."

Technical Level of Confidence: (choose one)	*Prototype* Demonstrated	__	*Elements* Built & Tested	__
	Similar *system* exists	__	Similar *technology* works	X
	Novel system concept	__	No candidate concept yet	__
	Other (Comment)			

Basis of the Cost Estimate:	Commercial product	15%	Engineered design	0%
(by percentage of total cost;	Engineered conceptual	65%	Scientist conceptual	5%
sum of fractions a-f = 100%)	Guess	15%	Other (specify)	0%

Status of Hardware/Software Development: "Pre-conceptual design of the trigger processor and the colorimeter digitizer module is just beginning. An analysis of the maximum throughput of data through the event builder is under way. Software development for data selection for writing to tape (Level-3 software trigger) will begin in the Fall."

Issues (funding, collaborator shortage, engineering help, etc.): "Substantial software development cannot begin until funding is in place so that new postdoctoral research associates can be hired at UMass and BU. While the BU group will take on the development of the trigger hardware and the UMass group will take on the development of the software trigger, adequate manpower to handle the slow control and monitoring system has not yet been identified."

RSVP Review Status Sheet

WBS No. 1.3.10 Title: "Installation and Integration" **Date 01/17/05**

Preparer/Manager: "Hebert" **Current Cost Est. (FY05 $M) = 3.20**
Assigned Contingency % = 27.6%

Cost Elements (FY05$M): Matls. = 0.11; Effort = 1.57; Ohd. = 0.86; Conting. = 0.66; Total = 3.20

WBS Dictionary Definition: "This task is will contain the installation efforts for all other subsystems in an effort to coordinate them into a single MECO installation plan. This task also includes integration of common systems across the whole of MECO and establishes the requirements for AGS conventional systems (power, chilled water, etc.). Integration includes the mechanical interface control tasks orchestrated by the MECO Chief Mechanical Engineer and similarly the eletrical interface tasks of the MECO Chief Electrical Engineer plus associated Designer effort in preparing envelope drawings, etc.."

Technical Level of Confidence: (choose one)	*Prototype* Demonstrated	__	*Elements* Built & Tested	__
	Similar *system* exists	__	Similar *technology* works	X
	Novel system concept	__	No candidate concept yet	__
	Other (Comment)			

Basis of the Cost Estimate:	Commercial product	0%	Engineered design	0%
(by percentage of total cost;	Engineered conceptual	50%	Scientist conceptual	50%
sum of fractions a-f = 100%)	Guess	0%	Other (specify)	0%

Status of Hardware/Software Development: "No designs for any specialized installation hardware. No modeling of installation sequencing. Minimal studies of services routing and subsystem envelopes have been completed."

Issues (funding, collaborator shortage, engineering help, etc.): "There are two major issues with the estimate and another with the system as a whole. In reverse order, the primary issue for this system is that we have not identified a suitable candidate for the MECO Chief Mechanical Engineer that is willing to accept the position. As a result, much needed development of both the I&I plans and their associated costs have languished. Addressing the costs, there are two problems here. The first is that to date, at the PM's request, each subsystem has been assessing its own installation needs and costs. Given the lack of a Chief ME, this seems the best way to make progress in the interim, but as a consequence, nearly none of the installation tasks that belong in this L3 WBS are found here. Instead they remain within each subdetector's WBS area, hence an artificially low number is seen for this effort. The final problem with the numbers quoted here is that they would benefit from another round of detailed comparison with the items in WBS 1.4.4 to be certain that there are no missed tasks or double counting. Time has not permitted such a MECO – BNL scrubbing exercise yet this year."

RSVP Review Status Sheet

WBS No. 1.3.11 Title: "MECO Project Office" **Date 01/17/05**

Preparer/Manager: "Hebert"

Current Cost Est. (FY05 $M) = 4.13
Assigned Contingency % = 28.7%

Cost Elements (FY05$M): Matls. = 0.47; Effort = 1.69; Ohd. = 1.06; Conting. = 0.92; Total = 4.13

WBS Dictionary Definition: "This task encompasses the personnel and tasks specifically associated with managing the MECO construction effort. Personnel include the MECO Project Manager, Cost and Schedule Manager, and an Administrative Assistant. Additional costs are included for office equipment and defraying the costs of reviewers for MECO."

Technical Level of Confidence:	*Prototype* Demonstrated	X	*Elements* Built & Tested	__
(choose one)	Similar *system* exists	__	Similar *technology* works	__
	Novel system concept	__	No candidate concept yet	__
	Other (Comment)			

Basis of the Cost Estimate:	Commercial product	0%	Engineered design	0%
(by percentage of total cost;	Engineered conceptual	0%	Scientist conceptual	20%
sum of fractions a-f = 100%)	Guess	0%	Other	80%
			Level of effort @ estimated salaries	

Status of Hardware/Software Development: "not applicable"

Issues (funding, collaborator shortage, engineering help, etc.): "New PM needs to be identified. Project office needs to be established at BNL.